REMARKS

The only independent claims remaining for the Examiner's consideration are claims 24, 28, 32 and 44. For purposes of this Amendment, the applicant relies on the same features in all of those claims to support patentability.

Original patent claims 7, 12, 13 and 22 have been amended to correct minor formal errors. Added independent reissue claims 24, 28 and 32 have been amended to include features from claim 40, which depended from those claims and has now been canceled. Independent claims 25-27, 29-31, 33-35 and 45 have also been canceled. Only allowed original patent claims 7-23, and added reissue claims 24, 28, 32, 37, 38, 41, 42 and 44 are in the application.

The present application is under appeal, but the applicant has not yet filed an amended appeal brief in response to the notice dated July 13, 2006, which indicated that the previous brief was not in compliance with 37 C.F.R. § 41.37. Accordingly, this Amendment is submitted pursuant to 37 C.F.R. § 41.33(a). The applicant believes that entry of the claim amendments presented herein is proper because it cancels rejected claims (and makes minor formal corrections). M.P.E.P. § 1206.

A Supplemental Declaration to cover the claim amendments made herein is enclosed.

The claims shown above appear as they will in the reissue patent issuing from the present application (that is, with added text underlined and deleted text in brackets), assuming that the present Amendment is deemed to place the application in condition for allowance. The status of all of the claims in the application is shown in the attached Appendix. The claim changes made by the present Amendment are shown in the Appendix by underlining text added to the claims and striking through text deleted from the claims.

Background of the Invention

All of the claims remaining for consideration include a conflict monitor compatibility circuit for LED-lit signaling devices controlled by a solid state traffic controller switch. Prior art traffic signals include a conflict monitor circuit as a safety feature. The conflict monitor circuit senses if signals being displayed conflict with each other, such as by showing green lights at two intersecting streets. This can happen if, say, a lightning strike creates a power surge that damages the solid state traffic controller switch and causes it to display conflicting green lights. A conflict monitor circuit detects the conflict and initiates remedial action to prevent accidents, such as changing all of the signals to a flashing-red mode.

However, using old-style conflict monitor circuits designed for incandescent lamp signals with more modern LED signals can cause false conflict detection. The applicant's conflict monitor compatibility circuit solves this problem, while still maintaining the low power consumption that is a primary reason for lighting traffic signals with LEDs in the first place.

One source of the false-conflict problem is a difference between the electrical characteristics of LEDs and incandescent lamps. An incandescent lamp that is switched on has a relatively high resistance in order to generate light. When power to the lamp is off, it exhibits a much lower resistance (impedance). Conflict monitor circuits sense that a lamp is off when a relatively low voltage is present due to the low lamp resistance. When operating properly, the conflict monitor circuit detects conflicting green lights by determining if the voltages associated with crossing streets' green lights exceed a predetermined value, indicating that the green lights for both streets are on at the same time. If so, the conflict monitor circuit assumes a traffic controller switch malfunction and changes the intersection to an all-flashing-red mode.

LED signals are different because, unlike incandescent lamps, they typically exhibit a relatively high input impedance in the presence of even low currents, such as normal leakage currents from a solid state traffic controller switch that is turned off. These leakage currents do not cause a problem with incandescent lamps because incandescent lamps have a relatively low impedance at these low leakage currents. But with an LED traffic signal, the voltage can be appreciable even when the traffic control switch is turned off. So when LEDs are combined with conflict monitor circuits that use elevated voltage to indicate the existence of a conflict (two "on" green lights at crossing streets), false conflict determinations can occur even if the traffic controller switch is functioning properly. This is because leakage currents, which are present during normal operation of the solid state traffic controller, are not shunted from the conflict monitor circuit by LEDs as they would be by incandescent lamps. In other words, a green-light LED subjected to leakage currents can create a high-voltage "false positive," which the conflict monitor circuit interprets as a lighted LED, even if it is not in fact lit. See the applicant's U.S. Patent 5,661,645 ("the original '645 patent"), col. 5, lines 15-30; <u>see also</u> U.S. Patent 5,075,601 to Hildebrand, col. 1, lines 11-33.

There were solutions to this problem before the applicant's invention, but none of them enabled full advantage to be taken of the low power consumption of LEDs as compared to other types of illuminating devices such as incandescent lamps or luminescent (neon or fluorescent) lights. One solution was placing a large capacitor across the inputs to the LEDs to absorb the leakage currents. This defeated the purpose of using LEDs for their low power consumption because of the reactive power drawn by the capacitor. <u>See</u> original '645 patent, col. 5, lines 23-30.

Another solution is shown in Hildebrand, which was used to reject the applicant's claims, but Hildebrand's "dynamic load circuit," like a capacitor, also mitigates the advantages of using LEDs in the first place. This is covered in more detail below in the discussion of the differences between the applicant's claims and Hildebrand.

Subject Matter of Claims 24, 28, 32 and 44

The applicant's solution is the conflict monitor compatibility circuit recited in claim 24, which for purposes of this discussion is representative of the remaining independent reissue claims. Claim 24 recites an LED signal power supply assembly with an electrical input that couples to an a.c. line through a solid state traffic controller switch. As discussed above, the use of LEDs (in combination with a switchmode power supply) causes the power supply to exhibit a "high impedance input condition," defined as when a voltage to the power supply exceeds a predetermined value in the presence of leakage currents from the solid state traffic controller switch.

The claimed conflict monitor compatibility circuit includes a transistor coupled to the LEDs and a low impedance load in series connection with the transistor and in parallel connection with the power supply input. The following claim language in particular distinguishes the applicant's invention from prior art traffic signal circuitry such as that shown in Hildebrand:

> the transistor is biased as a switch that in the absence of the high impedance input condition is in an essentially nonconductive condition and in the presence of the high impedance input condition switches to an essentially conductive condition for shunting leakage currents through the low impedance load.

The applicant's claimed conflict monitor compatibility circuit switches a low impedance load (such as a resistor) across the power supply input when the traffic controller switch is turned off. The conflict monitor circuit thus will detect a low voltage (indicative of a low impedance), just as it would if the traffic signal used incandescent lamps, thus making prior art conflict monitor circuits compatible with LED-lit signals.

The claimed structure accomplishes this by a unique combination of a transistor biased as a switch and a low impedance load. The transistor is "off" (nonconductive) in the absence of the claimed "high impedance input condition," when there are no leakage currents from the traffic controller switch because the signal is powered on. The transistor is switched "on" (conductive) in the presence of the high impedance input condition, when the traffic controller switch is off but leakage currents cause the voltage to exceed a predetermined value. At that point, the low impedance load is connected in parallel with the power supply input, thus presenting a low voltage to a conflict monitor and preventing high-voltage, "false positive" conflict indications.

Thus, only when two green-light LED traffic controller switches are actually on will there be sufficient voltage to indicate a conflict to the conflict monitor circuit. On the other hand, if the traffic controller switch is in fact turned off, the voltage detected by the conflict monitor circuit will indicate as such because the claimed low impedance load shunts leakage currents from the conflict monitor circuit and thereby mimics the impedance presented by an incandescent lamp that is turned off.

<u>The Claims Are Patentable Over the References of Record</u>

Claim 40, from which the conflict monitor compatibility circuit in claims 24, 28 and 32 was largely taken, was rejected under 35 U.S.C. § 103(a) as reciting subject matter that would

have been obvious from U.S. Patent No. 5,463,280 to Johnson in view of the Power Supply Cookbook, the Motorola data sheet for the MC 34261 controller, admitted prior art (Fig. 1 of the present application), and Hildebrand. Claim 44, which also claims a conflict monitor compatibility circuit, was rejected under 35 U.S.C. § 103(a) as reciting subject matter that would have been obvious from Johnson in view of Hildebrand.

While the applicant by no means concedes that it would have been obvious to combine Johnson, the Power Supply Cookbook, the Motorola data sheet for the MC 34261 controller, the admitted prior art, and Hildebrand as put forward in the rejections, the claims are patentable at least because no reference discloses or suggests the claimed conflict monitor compatibility circuit.

The final Office Action contended that Hildebrand's dynamic load circuit shown in Fig. 1A corresponds to the applicant's conflict monitor compatibility circuit. The rejection equated Hildebrand's MOSFET transistor Q3 and resistor R7 to the transistor and low impedance load, respectively, of the conflict monitor compatibility circuit in the applicant's claims.

Hildebrand's circuit operates in a manner that at first glance might seem similar to the applicant's claimed conflict monitor compatibility circuit. One of the purposes of Hildebrand's "dynamic load circuit" is to deal with leakage currents from a solid state controller switch. Col. 1, lines 15-18. Hildebrand says that its dynamic load circuit ensures that in a power-off condition "external alternating leakage current cannot create appreciable voltages at the input terminals." Col. 6, lines 60-65. Finally, Hildebrand recognizes that leakage current can cause a false conflict indication. Col. 1, lines 28-41.

But Hildebrand's solution to this problem differs from the applicant's. A major difference between Hildebrand's dynamic load circuit and the applicant's claimed conflict monitor compatibility circuit resides in the applicant's transistor coupled to the LEDs, which is "biased as a switch that in the absence of the high impedance input condition is in an essentially nonconductive condition and in the presence of the high impedance input condition switches to an essentially conductive condition for shunting leakage currents through the low impedance load." This transistor is different from Hildebrand's MOSFET Q3 in both structure and function.

The applicant's transistor is "biased as a switch," and Hildebrand's MOSFET Q3 is an amplifier. These are mutually exclusive ways to structure a transistor. See, for example, Lovell, B., et al., Lecture 12: 9E103 Electrical Physics and Electronics, University of Queensland, Nov. 5, 2000, http://www.itee.uq.edu.au/~engg1030/lectures/1perpage/lect12.pdf#search=%22 lecture%2012%20transistor%22, last visited October 12, 2006 (copy attached; listed on enclosed PTO/SB/08B). As explained in Lovell at pages 1-6, a transistor used as an amplifier is biased to ensure that the transistor operates in a desired current range. Hildebrand's Fig. 4 shows the operating range of the MOSFET amplifier transistor Q3; at column 6, lines 17-36, Hildebrand discusses the circuitry that provides the operating characteristics shown in Fig. 4. At page 10, Lovell sums up the difference between a transistor amplifier (like Hildebrand's MOSFET Q3) and a transistor switch (like that claimed by the applicant):

- For an amplifier, we want the transistor to operate in the linear region between cutoff and saturation [the dot-dash phantom line in Hildebrand's Fig. 4]
- For a switch, we drive the transistor between cutoff and saturation regions.

Thus, the applicant's claimed circuit operates differently from Hildebrand's. The applicant's transistor switch "is in an essentially nonconductive condition" in the absence of the defined "high impedance input condition." In contrast, Hildebrand's MOSFET Q3 conducts throughout the entire operating range of the circuit, meaning Hildebrand's transistor is in a conductive condition in the absence of the high impedance condition defined in the applicant's claims.

As noted above, this is seen in Hildebrand's Fig. 4, and is described at column 6, lines 11-15: "the circuit is such that the current decreases over part of its operating region with increasing voltage. This characteristic is shown, for example, in the curve of Fig. 4." In other words, although Q3's conductivity varies, it is never in a nonconductive condition during operation, in direct distinction from the applicant's claimed circuit. The current-voltage characteristic of MOSFET Q3 (the dot-dash phantom line in Fig. 4) confirms that Q3 conducts throughout its operating region (when leakage currents are not present), with its conductivity increasing linearly as the voltage decreases.

It is true that MOSFET Q3 is conductive in the presence of leakage currents from the solid state switch controlling the traffic signal (see, for example, col. 1, lines 15-18). But the solid line in Fig. 4 shows that Hildebrand's MOSFET is also conductive in the absence of leakage currents, reaching a maximum conductivity when the voltage reaches a certain value (about 10 volts in Fig. 4). It does not switch from nonconductive to conductive at a predetermined voltage when voltage exceeds a predetermined value in the presence of leakage currents, as recited in the applicant's claims.

Tests performed by the inventor further demonstrate the differences between the applicant's conflict monitor compatibility circuit and Hildebrand's dynamic load circuit. The test results are presented in the Declaration of Peter Hochstein in *Relume Corp. v. Dialight Corporation et al.*, Case No. 98-CV-72360, the U.S. District Court final decision reported at 63 F.Supp.2d 788 (E.D. Mich. 1999) ("the Hochstein Declaration"). The Hochstein Declaration was Exhibit 4 in document AV ("Exhibits in Support of Relume's Opposition to the Motion for Summary Judgment . . ."), which the Office Action of March 24, 2000, confirms is part of the record in the present application. A copy of the Hochstein Declaration and its exhibit 4 are enclosed for the Examiner's ease of reference. (To avoid burdening the record, copies of the remaining exhibits are not enclosed since they are already of record and are not referred to herein, although the applicant will provide additional copies if the Examiner would find it helpful.)

Exhibit 4 of the Hochstein Declaration directly compares the voltage-current characteristic of Hildebrand's circuit with that of the claimed conflict monitor compatibility circuit. The plot in Exhibit 4 labeled "Hildebrand Current" was generated using a circuit built in accordance with Hildebrand's disclosure. Hochstein Declaration, paras. 14-15. That plot closely matches the shape of the voltage-current characteristic in Fig. 4 of Hildebrand, in which the MOSFET transistor Q3 is conductive at essentially all voltages. In sharp contrast, the plot for the applicant's claimed switch-biased transistor/low impedance load ("Relume's Current") is conductive at low voltages, but is nonconductive at voltages above about 20 VAC.

The second plot comprising Exhibit 4 shows the drastic difference between the power dissipated by Hildebrand's circuit as compared to almost no power dissipation using the claimed

circuit. This plot illustrates at a glance that the claimed invention slashes the power consumption of Hildebrand's circuit. Hildebrand's low impedance load (resistor R7) remains in the circuit, drawing current, even in the absence of leakage currents. But because the applicant's switching transistor is in a nonconductive condition in the absence of leakage currents, the low impedance load is completely out of the circuit during normal operation. Thus, the applicant's invention preserves one of the main reasons for using LEDs in the first place: their low power consumption. For example, at 100 VAC, Hildebrand's dynamic load circuit consumes 3.5 watts, while the applicant's claimed circuit would consume only 0.3 watts. Thus, the amount of power consumed by Hildebrand's dynamic load circuit during normal operation would be a significant fraction of the total power consumed by an LED traffic signal, typical ratings for which at the time of the applicant's invention were about 14-20 watts. Original '645 patent, col. 1, line 62, to col. 2, line 2. Indeed, more recent LED traffic signals are rated as low as 6 watts, making the applicant's claimed circuit even more advantageous as compared to Hildebrand's dynamic load circuit. "Hi-Flux LED Modules – 433 Series Traffic Signals," Dialight Specification Sheet, http://www.dialight.com/pdf/TrafficSignals/MDTS433EXCAL001_A-W.pdf, last visited October 12, 2006 (copy attached; listed on enclosed PTO/SB/08B).

Another way of looking at the patentability of the applicant's claimed conflict monitor compatibility circuit is to consider whether it would have been obvious to replace Hildebrand's MOSFET transistor amplifier Q3 with a switch-biased transistor having the operational properties recited in the applicant's claims. When viewed from that perspective, it is even clearer that the applicant's claims are patentable. There is no suggestion in the prior art to make such a substitution, and there is certainly no suggestion that it would result in a drastic reduction in

power consumption. In fact, there would have been little motivation for one of ordinary skill in the art to use the applicant's claimed compatibility circuit, with its lower power consumption, in Hildebrand's luminescent-tube signal, since the 3.5 watts consumed by Hildebrand's dynamic load circuit is still a relatively small fraction of the power consumed by the typical fluorescent or neon lamp.

Accordingly, the applicant submits that claims 24, 28, 32 and 45, and their dependent claims, are clearly patentable over the art of record.

Entry of Claim Changes

As noted already, the claim changes introduced by this Amendment for the most part involve simply canceling rejected claims and incorporating features from canceled dependent claim 40 into its base independent reissue claims 24, 28, and 32. (There are also some minor formal changes to allowed patent claims 7, 12, 13 and 22.)

The changes to claims 24, 28 and 32 may appear at first glance to be more extensive, but that is only because they were not amended by merely inserting wholesale the language of claim 40. Rather, they were rewritten to more seamlessly integrate features in claim 40. In addition, the present Amendment intends that the conflict monitor compatibility circuit be of comparable scope in all of the remaining reissue claims. To that end, it was necessary to incorporate recitations from claim 44 into rewritten claims 24, 28, and 32, and *vice versa*.

In so doing, the "high impedance input condition," which was previously recited in claims 40 and 44, has been defined more explicitly as the condition in which "a voltage to the power supply input exceeds a predetermined value" in the presence of leakage currents from the solid state traffic controller switch. This claim language is supported in the original '645 patent

at column 7, lines 41-46. The applicant submits that this added recitation does not substantively change the claim.

The recited manner of operation of the applicant's claimed "transistor biased as a switch" has also been changed slightly. The new language (that the transistor "is in . . . an essentially nonconductive condition . . . and switches to an essentially nonconductive condition") has been introduced not to change the intended meaning of the claim language, but to emphasize even more the fundamental differences between Hildebrand's dynamic load circuit and the applicant's conflict monitor compatibility circuit. The applicant submits that this is also not a substantive change. Finally, the "electromagnetic interference filter means" has been deleted from claims 24, 28 and 32, since it is clearly not required for patentability.

Accordingly, the applicant respectfully requests entry of the claim changes presented herein pursuant to 37 C.F.R. § 41.33(a) and M.P.E.P. § 1206. The present Amendment cancels 13 of the 20 rejected claims, namely claims 3, 25-27, 29-31, 33-35, 40, 43 and 45. In addition, the remaining rejected independent claims 24, 28 and 32 have been amended to incorporate features of canceled dependent claim 40. Finally, those rejected claims and rejected independent claim 44 have been amended so that they all include the same patentability-imparting conflict monitor compatibility circuit.

While the applicant believes that the remaining reissue claims are all now patentable, entry of the present Amendment is requested in any case because it clearly places the application is better form for appeal by substantially reducing the issues requiring decision.

SUMMARY

For all of the reasons put forward above, the applicant believes that remaining original patent claims 7-23 and added reissue claims 24, 28, 32, 37, 38, 41, 42, and 44 are patentable, and requests that they be allowed.

The applicant's undersigned attorney would like to emphasize the applicant's desire to avoid the necessity of taking an appeal in this application. This Amendment is submitted to that end, and the applicant's attorney believes that an interview may help advance prosecution in that regard. The Examiner is requested to telephone the applicant's undersigned attorney to schedule an interview when this Amendment reaches the Examiner for consideration.

Any fees due in connection with this paper may be charged to Deposit Account No. 14-1131.

All correspondence and telephone inquiries should be directed to the applicant's undersigned attorney.

Respectfully submitted,

David M. Quinlan, Esq.
Attorney for Applicant
Registration No. 26,641

DAVID M. QUINLAN, P.C.
32 Nassau Street
Suite 300
Princeton, NJ 08542
Telephone: (609) 921-8660
Facsimile: (609) 921-8651
E-mail: david@quinlanpc.com

APPENDIX

Pursuant to 37 C.F.R. § 1.173(c), the following shows the current status of claims 1-45 of the above-identified application upon entry of the Amendment Under 37 C.F.R. § 41.33 of October 13, 2006, submitted herewith.

1. to 6. (Canceled)

7. (Currently amended) An apparatus for supplying regulated voltage d.c. electrical power to an LED array comprising:

a rectifier means (32) having an input and an output, said rectifier means (32) being responsive to a.c. power at said input for generating rectified d.c. power at said output;

a power factor correction converter means (38) having an input connected to said output of said rectifier means (32) and an output, said power factor correction converter means (38) being responsive to said rectified d.c. power at said power factor correction converter means input for generating regulated voltage d.c. power at said power factor correction converter means output;

an LED array (12), defined as consisting of series-parallel connected LED devices, having an input connected to said output of said power factor correction converter means (38) for receiving said regulated voltage d.c. power to illuminate said LED array (12); <u>and</u>

a battery backup means (62) having an input for receiving a.c. power applied to said input of said rectifier means (32) and having an output at which d.c. power is generated, and a switch-over means (82) connected to said output of said battery backup means (62) and to said rectifier means input, said battery backup means (62) being responsive to a failure of a.c. power at said

battery backup means input for controlling said switch-over means (82) to connect said output of said battery backup means (62) to said input of said rectifier means (32) to provide d.c. power to illuminate said LED array (12) and being responsive to a.c. power at said battery backup means input for controlling said switch-over means (82) to disconnect said battery backup means output from said rectifier means input.

8. (Original) The apparatus according to claim 7 wherein said switch-over means (82) is an electromechanical relay.

9. (Original) The apparatus according to claim 7 wherein said battery backup means (62) includes a time delay and restoration means (78) responsive to application of a.c. power at said input of said battery backup means (62) for controlling said switch-over means (82) to disconnect said output of said battery backup means (62) from said input of said full wave rectifier means (32) and connect the a.c. power to said full wave rectifier means input after a predetermined time delay.

10. (Original) The apparatus according to claim 7 wherein said battery backup means (62) includes a dc. power switch-over and flasher means (80) connected to said switch-over means (82) for pulsing said dc. power at a predetermined rate to flash said LED array (12).

11. (Original) The apparatus according to claim 7 wherein said battery backup means (62) includes a synchronizing pulse generator means (86) connected to said d.c. power switchover and flasher means (80) for imposing marker pulses on said d.c. power at a predetermined rate.

12. (Currently amended) An apparatus for supplying regulated voltage d.c. electrical power to an LED array comprising:

a rectifier means (32) having an input and an output, said rectifier means (32) being responsive to a.c. power at said input for generating rectified d.c. power at said output;

a power factor correction converter means (38) having an input connected to said output of said rectifier means (32) and an output, said power factor correction converter means (38) being responsive to said rectified d.c. power at said power factor correction converter means input for generating regulated voltage d.c. power at said power factor correction converter means output;

an LED array (12), defined as consisting of series-parallel connected LED devices, having an input connected to said output of said power factor correction converter means (38) for receiving said regulated voltage d.c. power to illuminate said LED array (12); and

a half wave power detector means (88) having an input connected to said input of said rectifier means (32) and an output connected to another input of said power factor correction converter means (38), said half wave power detector means (88) being responsive to a dimming signal at said rectifier means input for generating a control signal at said half wave power detector means output and said power factor correction converter means (38) being responsive to said control signal for decreasing said regulated d.c. power to dim said LED array (12).

13. (Currently amended) The apparatus for supplying regulated voltage d.c. electrical power to an LED array comprising:

a rectifier means (32) having an input and an output, said rectifier means (32) being responsive to a.c. power at said input for generating rectified d.c. power at said output;

a power factor correction converter means (38) having an input connected to said output of said rectifier means (32) and an output, said power factor correction converter means (38) being responsive to said rectified d.c. power at said power factor correction converter means input for generating regulated voltage d.c. power at said power factor correction converter means output;

an LED array (12) defined as consisting of series-parallel connected LED devices, having an input connected to said output of said power factor correction converter means (38) for receiving said regulated voltage d.c. power to illuminate said LED array (12); <u>and</u>

a pulse width modulated modulator means (46) connected to said output of said power factor correction converter means (38) and to said input of said LED array (12) for modulating said regulated voltage d.c. power and a half wave power detector means (88) having an input connected to said input of said rectifier means (32) and an output connected to an input of said pulse width modulated modulator means (46), said half wave power detector means being responsive to a dimming signal said rectifier means input for generating a control signal at said half wave power detector means output and said pulse width modulated modulator means (46) being responsive to said control signal for decreasing said regulated d.c. power to dim said LED array (12).

14. (Original) An apparatus for supplying regulated voltage d.c. electrical power to an LED array comprising:

a power supply means (10) having an input and an output, said power supply means (10) being responsive to a.c. power at said input for generating regulated voltage d.c. power at said output to illuminate an LED array (12) connected to said power supply means output; and

a dimming detector means (88) having an input connected to said input of said power supply means (10) and an output connected to another input of said power supply means (10), said dimming detector means (88) being responsive to a dimming signal at said power supply means input for generating a control signal at said dimming detector means output and said power supply means (10) being responsive to said control signal for decreasing said regulated voltage d.c. power to dim the LED array (12).

15. (Original) The apparatus according to claim 14 wherein said dimming detector means (88) is a half wave power detector means, said dimming signal is half wave rectified a.c. power and said power supply means (10) includes a rectifier means (32) having an input connected to said power supply means input and an output and a power factor correction converter means (38) having an input connected to said rectifier means output and an output connected to said power supply output, said power factor correction converter means (38) including said another input of said power supply means (10), said power factor correction converter means (38) being responsive to said control signal for decreasing said regulated voltage d.c. power to dim the LED array (12).

16. (Original) The apparatus according to claim 14 wherein said dimming detector means (88) is a half wave power detector means. said dimming signal is half wave rectified a.c. power and including a pulse width modulated modulator means (46) connected to said output of said power supply means (10) for modulating said regulated voltage d.c. power, said pulse width modulated modulator means (46) including said another input of said power supply means (10), said pulse width modulated modulator means (46) being responsive to said control signal for decreasing said regulated voltage d.c. power to dim the LED array (12).

17. (Original) An apparatus for supplying regulated voltage d.c. electrical power to an LED array comprising:

a rectifier means (32) having an input and an output, said rectifier means (32) being responsive to a.c. power at said input for generating rectified d.c. power at said output;

a power factor correction converter means (38) having an input connected to said output of said rectifier means (32) and an output, said power factor correction converter means (38) being responsive to said rectified d.c. power at said power factor correction converter means input for generating regulated voltage d.c. power at said power factor correction converter means output;

a battery backup means (62) having an input for receiving a.c. power applied to said input of said rectifier means (32) and having an output at which d.c. power is generated; and

a switch-over means (82) connected to said output of said battery backup means (62) and to said input of said rectifier means (32), said battery backup means (62) being responsive to a failure of a.c. power at said battery backup means input for controlling said switchover means (82) to connect said battery backup means output to said rectifier means input to provide d.c. power to said power factor correction converter means (38) to illuminate an LED array connected to said output of said power factor correction converter means (38) and being responsive to a.c. power at said battery backup means input for controlling said switch-over means (82) to disconnect said battery backup means output from said rectifier means input.

18. (Original) The apparatus according to claim 17 wherein said power factor correction converter means (38) is a power factor correcting and voltage regulating buck/boost switchmode converter.

19. (Original) The apparatus according to claim 17 including an adaptive clamp circuit means (24) connected to said input of said rectifier means (32) for eliminating leakage current problems, said adaptive clamp circuit means (24) having an input adapted to be connected to a pair of a.c. power lines (22), a pair of clamp circuit output lines (26) connected to said adaptive clamp circuit means input, a voltage sensing means (48) connected across said adaptive clamp circuit means input, and a controlled load means (50) connected across said clamp circuit output lines (26) and to said voltage sensing means (48), said voltage sensing means (48) being responsive to a magnitude of a.c. voltage at said adaptive clamp circuit means input lower than a predetermined magnitude for turning on said controlled load means (50) to connect a low impedance load (60) in said controlled load means (50) across said clamp circuit output lines (26) and said voltage sensing means (48) being responsive to a magnitude of the a.c. voltage at said adaptive clamp circuit means input equal to or greater than said predetermined magnitude for turning off said controlled load means (50) to disconnect said low impedance load (60) from said clamp circuit output lines (26).

20. (Original) The apparatus according to claim 17 wherein said battery backup means (62) includes a time delay and restoration means (78) responsive to application of a.c. power at said input of said battery backup means (62) for controlling said switch-over means (82) to disconnect said output of said battery backup means (62) from said input of said rectifier means (32) and connect the a.c. power to said rectifier means input after a predetermined time delay.

21. (Original) The apparatus according to claim 17 wherein said battery backup means (62) includes a d.c. power switch-over and flasher means (80) connected to said switch-over means (82) for pulsing said d.c. power at a predetermined rate to flash said LED array (12).

22. (Currently amended) The apparatus according to claim 17 wherein ~~Wherein~~ said battery backup means (62) includes a synchronizing pulse generator means (86) connected to said d.c. power switch-over and flasher means (80) for imposing marker pulses on said d.c. power at a predetermined rate.

23. (Original) An apparatus for supplying regulated voltage d.c. electrical power to an LED array comprising:

a rectifier means (32) having an input and an output, said rectifier means (32) being responsive to a.c. power at said input for generating rectified d.c. power at said output;

a power factor correcting and voltage regulating buck/boost switchmode converter (38) having an input connected to said output of said rectifier means (32) and an output, said switchmode converter (38) being responsive to said rectified d.c. power at said switchmode converter input for generating regulated voltage d.c. power at said switchmode converter output;

an LED array (12) having an input connected to said output of said switchmode converter (38) for receiving said regulated voltage d.c. power to illuminate said LED array (12);

a battery backup means (62) having an input for receiving a.c. power applied to said input of said rectifier means (32) and having an output at which d.c. power is generated; and

a switch-over means (82) connected to said output of said battery backup means (62) and to said input of said rectifier means (32), said battery backup means (62) being responsive to a failure of a.c. power at said battery backup means input for controlling said switchover means

(82) to connect said battery backup means output to said rectifier means input to provide d.c. power to said switchmode converter (38) to illuminate said LED array (12) and being responsive to a.c. power at said battery backup means input for controlling said switch-over means (82) to disconnect said battery backup means output from said rectifier means input.

24. (Currently amended) A power supply assembly for powering light emitting diodes (LEDs) in an outdoor line-connected signal, comprising:

an electrical input for coupling to a source of a.c. line voltage through a solid state traffic controller switch;

a rectifier coupled to the electrical input and having a rectifier output;

a line voltage regulating switchmode power supply having a power supply input coupled to the rectifier output and having a power supply output;

a plurality of LEDs coupled to the power supply output and having multiple current paths for dissipating power and emitting light in response to the power supply output, wherein the power supply exhibits a high impedance input condition in which a voltage to the power supply exceeds a predetermined value in the presence of leakage currents from the solid state traffic controller switch;

~~an electromagnetic interference filter means coupled to the power supply for preventing conducted interference from feeding back onto a.c. power lines connected to the electrical input~~

a conflict monitor compatibility circuit including a transistor coupled to the LEDs and a low impedance load in series connection with the transistor and in parallel connection with the power supply input, wherein the transistor is biased as a switch that in the absence of the high

impedance input condition is in an essentially nonconductive condition and in the presence of the high impedance input condition switches to an essentially conductive condition for shunting leakage currents through the low impedance load; and

a traffic, pedestrian or rail crossing signal housing enclosing the assembly.

25. to 27. (Canceled)

28. (Currently amended) A power supply assembly for powering light emitting diodes (LEDs) in an outdoor line-connected signal, comprising:

an electrical input for coupling to a source of a.c. line voltage through a solid state traffic controller switch;

a rectifier coupled to the electrical input and having a rectifier output;

a switchmode power supply coupled to the output of the rectifier for maintaining current and voltage waveforms substantially in phase and for providing a regulated current output with respect to variations in the input line voltage;

a plurality of LEDs coupled to the power supply output and having multiple current paths for dissipating power and emitting light in response to the power supply output, wherein the power supply exhibits a high impedance input condition in which a voltage to the power supply exceeds a predetermined value in the presence of leakage currents from the solid state traffic controller switch;

~~an electromagnetic interference filter means coupled to the power supply for preventing conducted interference from feeding back onto a.c. power lines connected to the electrical input~~

a conflict monitor compatibility circuit including a transistor coupled to the LEDs and a low impedance load in series connection with the transistor and in parallel connection with the power supply input, wherein the transistor is biased as a switch that in the absence of the high impedance input condition is in an essentially nonconductive condition and in the presence of the high impedance input condition switches to an essentially conductive condition for shunting leakage currents through the low impedance load; and

a traffic, pedestrian or rail crossing signal housing enclosing the assembly.

29. to 31. (Canceled)

32. (Currently amended) A power supply assembly for powering light emitting diodes (LEDs) in an outdoor line-connected signal, comprising:

an electrical input for coupling to a source of a.c. line voltage through a solid state traffic controller switch;

a rectifier coupled to the electrical input and having a rectifier output;

a current regulating switchmode power supply coupled to the output of the rectifier for improving poor power factor, whereby the power supply provides essentially constant current at a power supply output with respect to variations in line voltage input, and whereby current and voltage waveforms are maintained substantially in phase;

a plurality of LEDs coupled to the power supply output and having multiple current paths for dissipating power and emitting light in response to the power supply output, wherein the power supply exhibits a high impedance input condition in which a voltage to the power supply exceeds a predetermined value in the presence of leakage currents from the solid state traffic controller switch;

~~an electromagnetic interference filter means coupled to the power supply for preventing conducted interference from feeding back onto a.c. power lines connected to the electrical input~~

a conflict monitor compatibility circuit including a transistor coupled to the LEDs and a low impedance load in series connection with the transistor and in parallel connection with the power supply input, wherein the transistor is biased as a switch that in the absence of the high impedance input condition is in an essentially nonconductive condition and in the presence of the high impedance input condition switches to an essentially conductive condition for shunting leakage currents through the low impedance load; and

a traffic, pedestrian or rail crossing signal housing enclosing the assembly.

33. to 36. (Canceled)

37. (Currently amended) The assembly according to claim 24, 28 or 32 ~~claims 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34 or 35~~ wherein the switchmode power supply comprises an integrated circuit power supply.

38. (Previously presented) The assembly of claim 37 wherein the integrated circuit power supply comprises a power factor correcting switchmode converter integrated circuit.

39. and 40. (Canceled)

41. (Currently amended) The assembly according to claim 24, 28 or 32 ~~claims 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34 or 35~~ wherein the plurality of LEDs comprise a plurality of series-parallel connected LEDs arranged in strings.

42. (Previously presented) The assembly according to claim 41 wherein the plurality of LEDs comprise a ballast resistor in each string.

43. (Canceled)

44. (Currently amended) A conflict monitor compatibility circuit for use in traffic and pedestrian signaling applications, comprising:

a plurality of LEDs for emitting light in response to a switchmode power supply, wherein the power supply exhibits ~~an LED load providing~~ a high impedance input condition in which a voltage to the power supply exceeds a predetermined value in the presence of leakage currents from a solid state traffic controller switch;

a transistor coupled to the LEDs ~~LED load~~ and biased as a switch that is in ~~switches from~~ an essentially nonconductive condition in the absence of the high impedance input condition and switches to an essentially conductive condition in the presence of the high impedance input condition; and

a low impedance load in series connection with the transistor and in parallel connection with the power supply input for shunting ~~LED load, whereby~~ leakage currents ~~are shunted~~ through the low impedance load when the transistor is in the conductive condition~~, ensuring compatibility with conflict monitors designed for incandescent bulbs~~.

45. (Canceled)